ENVI SERVICES ENGINE

ENVI® for ArcGIS® - Services Edition 5.3 User Guide

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ENVI® for ArcGIS® - Services Edition

ENVI® for ArcGIS® - Services Edition (EFASE) provides image analysis tools that you can publish to the ArcGIS® for Server environment. These tools use ENVI Services Engine (ESE) to automate image-processing tasks such as RPC orthorectification, change detection, and classification. Use the ArcGIS Model Builder to chain together various ENVI image-processing tasks. Or, use ENVI desktop to create custom geo-processing tools and distribute them to desktop users, mobile clients, or web applications, so that they are readily available and utilized across your entire organization within the ArcGIS product suite. You can also share tools (rendered as maps and their conjugate map services) on the ArcGIS® Online portal.

EFASE is supported with ArcGIS for Server versions 10.1 SP1 and 10.2+.

See the following sections:

- Installation
- ArcMap Software and ESE on Different Systems
- ArcServer Host and ESE on Different Systems
- Publish Included Tools as Services
- Build Models
- Administrative Tools

Installation

1. Insert the installation disk in the appropriate drive. The autorun program should start automatically. If the autorun program does not start, select **Start** > **Run**. In the Run dialog, click **Browse** to navigate to the drive, select `autorun.exe`, and click **OK**.
2. Click the **Install** button. If you do not already have IDL and ENVI installed, you will be prompted to install them.
3. Select the **ENVI for ArcGIS - Services Edition** option to install ESE along with ENVI for ArcGIS - Services Edition (EFASE).
4. Choose whether or not to install ESE as a *service* so that it will run as a background process that performs without any user interaction:
    - **Yes, setup the service to start automatically:** Select this option to automatically start the ESE service after a system reboot. This option is

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convenent for clustered environments with numerous machines.

- **Yes, setup the service to start manually:** Select this option to manually control when the ESE service runs. See Stop and Start the System for instructions on manually stopping and starting the ESE service after installation.
- **No:** Choose this option if you will run ESE as an application rather than as a service. See Start ESE As An Application for instructions after installation is complete.

5. If you selected to start the service automatically or manually, you are prompted to enter a **User name** and **Password**. The user account must have a password; a blank password or no password will not work with ESE. Click the **New User Information** button to establish a new user account if needed. Install as a user with restricted privileges because this type of installation poses security hazards. This is because ESE runs with the same permissions as the specified user, including the ability to delete and modify directories and files.
6. Choose the work directory location. The default folder is `C:\Exelis`. Click **Next**.
7. If you chose to install EFASE in addition to ESE, A question dialog asks, "Is this installation on a system that has or will have ArcGIS Server?"

   If ArcGIS for Server software, ESE, and EFASE are on the same system, click **Yes**.

   If ArcGIS for Server software is installed on a system (referred to as the ArcServer *host*) that is separate from that of ESE, click **No**. You are then prompted to select the directories that the ArcServer and ESE will share. Forward slashes are required. The default values are as follows:

   Temporary Directory: `//ArcServerHostName/Public/AppData/Local/Temp`
   Replace *ArcServerHostName* with the actual host name. The Temporary directory must be on the ArcServer system's local drive.

   Jobs Directory:
   `//ArcServerHostName/arcgisserver/directories/arcgisjobs`
   Replace *ArcServerHostName* with the actual host name. The Jobs directory can be on the ArcServer system's local drive or on a network location.

   These directories do not need to exist yet; see ArcServer Host and ESE on Different Systems for instructions on configuring these directories later.
8. When the installation is complete, you can optionally run the License Wizard. If you choose not to run the License Wizard now, click **No**.

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- To run the License Wizard after installation, select **Start** > **Programs** > **ENVI x.x** > **Tools** > **License Wizard**. Follow the screens to point to a valid license server or to install a license file.
- You can also copy the `license.dat` file to the folder on your machine that contains the installation files for IDL and/or ENVI. The default location is `C:\Program Files\Exelis\License`.

9. Navigate to *`ESE install path`*`\se5x\docroot\efase`.
10. Extract the contents of `clienttoolbox.zip` to the following directory:

    `C:\Users\username\My Documents\ArcGIS`

ArcMap Software and ESE on Different Systems

Follow these steps if ESE is installed on a server separate from where ArcMap software will be used to publish tasks.

Skip these steps if ArcMap software and ESE are on the same system.

1. Ensure that both the account that will run the ArcMap software and the service account that runs ESE have read and write access to the shared temporary directory.
2. From the ArcMap menu bar, select **Geoprocessing > Environments**.
3. Expand the **Workspace** category.
4. In the **Scratch Workspace** field, enter the temporary directory and append `Default.gdb`. For example: `\\`*`server`*`\Public\AppData\Local\Temp\Default.gdb`
5. Click **OK**.

ArcServer Host and ESE on Different Systems

Follow these steps if you selected **No** in Step 7 of the Installation section, that is, if the ArcGIS for Server software is installed on a system (referred to as the ArcServer *host*) that is separate from that of ESE.

Skip this section if ESE and ArcServer are on the same system.

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Set Up Temporary and Jobs Network Shares

1. Log into the ArcServer host with an administrator account.
2. Create a folder on the ArcServer host that both ESE and ArcGIS for Server software can access. The example here uses the `C:\Users\Public` folder, which should exist on most ArcServer hosts running on Windows 2008 Server. Using this folder is preferable if the ArcServer service account is a local account, in which case the ESE service account must be a network account. If you are using a different operating system than Windows 2008 server, you may need to identify another folder to use for sharing.
3. Create a temporary directory and a jobs directory within this folder on the ArcServer host. These are the *network shares*. For example:

   ```
   C:\Users\Public\AppData\Local\Temp
   C:\Users\Public\arcgisserver\directories\arcgisjobs
   ```

   The folders after `C:\Users\Public` can be anything you want; the examples just show the default paths.

Ensure Read and Write Access to the Directories

In these steps, you will ensure that the user account that runs ArcGIS for Server software and the user account that runs ESE have read and write access to the temporary and jobs network shares. This example assumes the use of Windows Server 2008; adjust the steps as needed for a different operating system.

1. Log on to the ArcServer host with an administrative account.
2. Right-click on the `Public` folder and select **Share**.
3. In the Public Properties dialog, click the **Advanced Sharing** button.
4. Enable the **Share this folder** option, then click **OK**.
5. In the Public Properties dialog, follow the hyperlink to **Network and Sharing Center**.
6. In the Sharing and Discovery section, turn **On** the **File sharing** and **Public folder sharing** options.
7. Expand the **Public folder sharing** section.
8. Enable the option **Turn on sharing so anyone with network access can open, change, and create files**.
9. Turn **Off** the option for **Password protected sharing**.
10. Click **Apply**, then close the Network and Sharing Center dialog.

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Set ArcGIS for Server to Use the Jobs Network Share

1. If you have not already done so, establish a connection to the ArcGIS server.
2. Right-click on the server connection in ArcMap and select **Server Properties**. Alternatively, open the ArcGIS Server Manager (enter `hostname:port/arcgis/manager` in a web browser), select **Site** in the top menu, then select **Directories** in the left menu.
3. Edit the **Jobs** directory to point to the jobs network share that you created earlier. You must express the location as a Universal Naming Convention (UNC) path, for example: `\\server\Users\Public\etc`.
4. Click **Apply**. Click **OK** to close the Server Properties dialog.

Set Environment Variables in the ArcGIS Service Account

In these steps, you will set the Windows TEMP and TMP environment variables (for the ArcGIS Server user account) to the temporary network share.

1. Log into the ArcServer host with an administrative account.
2. Add the local ArcGIS Server user account to the administrators group.
3. Log in to the ArcGIS Server host using the ArcGIS service account.
4. In Windows, right-click on **Computer** and select **Properties**.
5. Click **Advanced system settings**, then **Environment Variables**.
6. Edit the user variables **TEMP** and **TMP** to point to the local directory used for the temporary network share (for example, `C:\Users\Public\AppData\Local\Temp`).
7. If needed, remove the local ArcGIS Server user account from the administrators group after performing the previous steps.
8. Re-start the ArcGIS for Server software.
9. If you ever need to confirm your settings, you must log out of the ArcGIS Server host, then log back in.

Publish Included Tools as Services

The following ENVI image-processing tools are available for publishing.

- **AdditiveLeeAdaptiveFilter**: Apply a Lee adaptive filter to smooth noisy data that has an additive component.

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- **AdditiveMultiplicativeLeeAdaptiveFilter**: Apply a Lee adaptive filter to smooth noisy data that has an additive and multiplicative component.
- **AutoChangeThresholdClassification**: Perform image change detection using automatic thresholding.
- **BinaryGTThresholdRaster**: Create a raster where values above a specified threshold are set to 1 and all other values are set to 0.
- **BinaryLTThresholdRaster**: Create a raster where values below a specified threshold are set to 1 and all others are set to 0.
- **BitErrorAdaptiveFilter**: Apply a bit error adaptive filter to a raster.
- **ChangeThresholdClassification**: Perform image change detection using manual thresholding.
- **ClassificationAggregation**: Clean up classification results using an aggregation operation.
- **ClassificationSieving**: Perform a sieving cleanup operation on a classification image.
- **ClassificationSmoothing**: Clean up classification results using a smoothing operation.
- **ClassificationToShapefile**: Export a classification image to a shapefile.
- **ColorSliceClassification**: Create a classification raster by thresholding on select data ranges and colors to highlight areas of a raster.
- **DarkSubtractionCorrection**: Perform dark subtraction atmospheric correction.
- **DimensionsResampleRaster**: Resample an image to different spatial dimensions.
- **EnhancedFrostAdaptiveFilter**: Apply an enhanced Frost filter to a raster, to reduce speckling while preserving edges.
- **EnhancedLeeAdaptiveFilter**: Apply an enhanced Lee filter to a raster, to reduce speckling while preserving texture information.
- **EqualizationStretchRaster**: Apply an equalization stretch to a raster.
- **ForwardICATransform**: Perform a forward independent component analysis (ICA) transform.
- **ForwardMNFTransform**: Perform a forward minimum noise fraction (MNF) transform.

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- **ForwardPCATransform**: Perform a forward principal components analysis (PCA) transform.
- **FrostAdaptiveFilter**: Apply a Frost filter to a raster, to reduce speckling while preserving edges.
- **FXSegmentation**: Perform a Feature Extraction segment-only workflow.
- **GammaAdaptiveFilter**: Apply a gamma filter to a raster, to reduce speckling while preserving edges.
- **GaussianStretchRaster**: Apply a Gaussian stretch to a raster.
- **GeographicSubsetRaster**: Subset a raster by geographic location.
- **GramSchmidtPanSharpening**: Perform Gram-Schmidt pan sharpening.
- **HighClipRaster**: Create a new raster where values above a threshold are set to the threshold.
- **ImageBandDifference**: Perform a difference analysis on a specific band in two images.
- **ImageIntersection**: Compute the overlapping area of two images.
- **ISODATAClassification**: Perform unsupervised classification using the ISODATA method.
- **KuanAdaptiveFilter**: Apply a Kuan adaptive filter to a raster.
- **LinearPercentStretchRaster**: Apply a linear percent stretch to a raster.
- **LinearRangeStretchRaster**: Apply a linear stretch to a raster, based on minimum and maximum pixel values.
- **LocalSigmaAdaptiveFilter**: Apply a Local Sigma adaptive filter to a raster.
- **LogStretchRaster**: Apply a logarithmic stretch to a raster.
- **LowClipRaster**: Apply a low-pass filter to a raster.
- **MaskRaster**: Export a mask raster to an ENVI-format file.
- **MedianFilter**: Apply a median filter to a raster.
- **MultiplicativeLeeAdaptiveFilter**: Apply a Lee adaptive filter to smooth noisy data that has a multiplicative component.
- **NNDiffusePanSharpening**: Perform NNDiffuse pan sharpening.
- **OptimizedLinearStretchRaster**: Apply an optimized linear stretch to a raster.
- **PCPanSharpening**: Perform PC pan sharpening.

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- **PercentThresholdClassification**: Segment an image into anomalous and non-anomalous regions.
- **PixelScaleResampleRaster**: Resample a raster to different dimensions by multiplying the pixel size by a scale factor.
- **QUAC**: Use QUick Atmospheric Correction (QUAC®).
- **QuerySpectralIndices**: Determine which spectral indices are available for a given image.
- **RadiometricNormalization**: Create an image from two rasters that minimizes their differences caused by inconsistent image acquisition conditions.
- **RobertsFilter**: Apply a Roberts filter to a raster.
- **RootStretchRaster**: Apply a square root stretch to a raster.
- **RXAnomalyDetection**: Perform Reed-Xiaoli (RX) anomaly detection.
- **SobelFilter**: Apply a Sobel filter to a raster.
- **SpectralIndex**: Create a spectral index image from one pre-defined index.
- **SpectralIndices**: Create a multi-band image where each band is a different spectral index.
- **SubsetRaster**: Subset a raster using pixel coordinates.
- **ThematicChange**: Take two classification images of the same scene taken at different times and identify differences between them.
- **VegetationSuppression**: Remove the vegetation spectral signature from multispectral and hyperspectral imagery.

Follow these steps to publish the tools as services:

1. Start the ArcMap software, then open the Catalog window.
2. Connect to the directory where you extracted the contents of `clienttoolbox.zip` (see Step 10 under Installation).
3. Ensure that the ArcGIS for Server connection is set up with a publishing or administrative account.
4. Start ENVI Services Engine (ESE).
5. Expand the **ENVI Tools - Server.pyt** toolbox in the ArcCatalog window.
6. Double-click **Publish Services**.
7. In the Publish Services dialog, complete the entries as follows:
    - **ENVI Services Folder URL**: Enter the path to the folder containing the ESE services, for example: `http://server:port/ese/services`.

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- **Choose a connection**: Select the ArcGIS Server connection from the drop-down list. This step assumes that you previously added the server to the list of available GIS Servers in the ArcCatalog™ software. If the ArcGIS Server connection is not listed after you set up a connection, right-click on **Toolbox** and select **Refresh**.
- **ArcGIS Server Folder**: Enter a valid name for an ArcGIS Server folder that will contain the tasks (i.e., it must not contain any illegal characters such as spaces). If you do not enter a name, the tasks will be published to the ArcServer root folder.

8. Expand the **Choose Tasks** category.
9. Enable the **Publish only selected Tasks** option to choose specific tasks to publish. If you leave this option disabled, all available tasks will be published. You must enter a URL in the **ENVI Services Folder URL** field for this option to be available.
10. From the **Service** drop-down list, select **ENVI** to publish ENVI image-processing tasks.
11. In the **Tasks** section, select the specific tasks to publish.
12. Leave the **Publishing Options** at their default settings.
13. Optionally enter a **Username**, **Password**, and **ArcGIS Portal URL** if you want to share these tools on an ArcGIS Online portal.
14. Click **OK**. When processing is complete, the ENVI tools will be available on the ArcGIS Server host and optionally the ArcGIS Online portal.

    The publishing process can take several minutes, depending on the number of tasks and the server speed.
15. Go to the ArcGIS Server name in the catalog, and double-click the tools to run them.

Each tool contains a number of parameters that you must specify. Click the **Show Help** button at the bottom of the tool dialog to see descriptions of each parameter. In most cases, you can fill in the **Input Raster** field with the name of the source image to use with the tool. However, ArcMap software converts all non-TIFF formats to TIFF format. Also, tools will fail in ArcMap software if any input rasters exceed 42 MB in size. To get around these limitations, fill in the **Input Raster Source** field while leaving the **Input Raster** field blank. The **Input Raster Source** field is under the **Auxiliary Data** section. Enter the shared path to the source image file, using the following format: *network file server*/*path*/*filename*.

In the **Input Auxiliary Files** field, select any auxiliary files needed for processing. Examples include ENVI header files (`.hdr`), TIFF world files (`.tfw`), etc.

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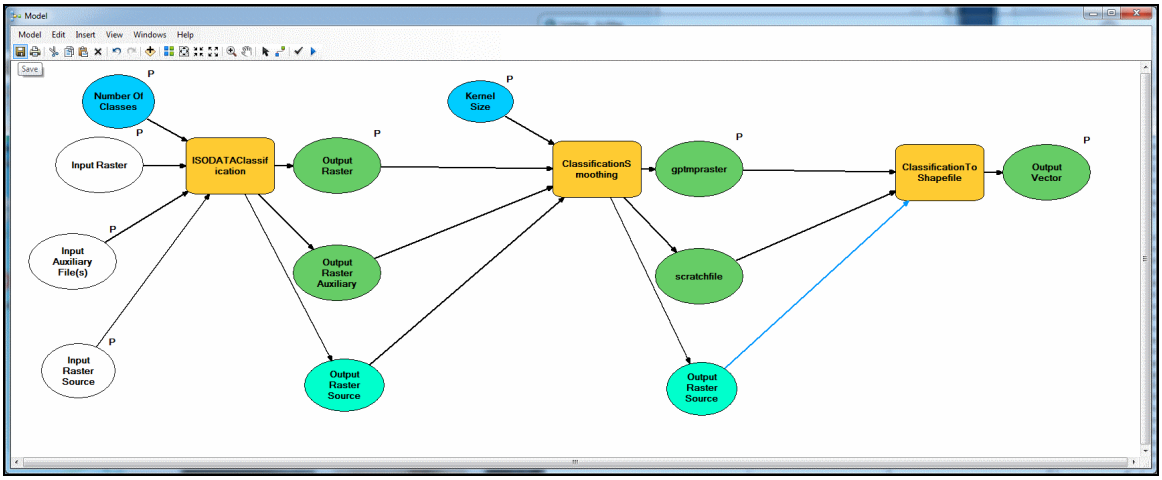
The **Output Raster** field provides the name of the output raster generated from the tool. The **Output Raster Source** field provides the shared path to the output raster. The **Output Raster Auxiliary** field provides the name of any associated auxiliary files such as header files, TIFF world files, etc. The default values are sufficient for most cases; you should not need to change them.

Build Models

Use the ArcGIS ModelBuilder to string together ENVI tools and create image-processing workflows. This section explains at a high level how to build models from ENVI tools; refer to the ArcGIS Help for further instructions on using ModelBuilder.

The following figure shows an example model that runs ISODATA classification, followed by classification smoothing and exporting the classification results to a shapefile:



1. From the ArcMap menu bar, select **Geoprocessing > ModelBuilder**.
2. Drag the first task from the Catalog into the ModelBuilder Canvas.
3. Right-click on the task and select **Make Variable > From Parameter**. Select the input parameters for the task. See the discussion that follows Step 15 of Publish Included Tools as Services, for a brief description of input rasters.
4. Repeat with other tasks as needed.
5. Click to select all of the input parameters for each task, along with top-most output parameters. Right-click and select **Model Parameter**. The corresponding parameters are marked with a "P." The above figure shows an example.
6. Right-click on the final output variable and select **Add To Display**.

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7. Use the **Connect** tool to connect each task output to its corresponding input for the task that follows it.
8. Save the model to a toolbox.

Administrative Tools

This section describes the administrative tools available with an installation of EFASE, as well as descriptions of each field.

New Service

Create a new ESE service.

- **ENVI Services URL Folder:** The URI containing the ESE service (for example, `http://server:port/ese/services/my_favorites`).
- **Service Name:** The name of the new service.
- **Execution Type:** Synchronous execution is appropriate for service tasks that are guaranteed to process rapidly; other tasks should be executed asynchronously.
- **Description:** A summary description of the service.
- **Tags:** Tags associated with the service.

Publish Services

Publish geo-processing services that perform ENVI image analysis tasks.

- **ENVI Services URL Folder:** The URI containing the ESE service (for example, `http://server:port/ese/services/my_favorites`).
- **Choose a connection (optional):** The ArcGIS Server connection that will be used to publish the services. This connection must be either a publisher or administrative connection. If a connection is not specified, the tool will complete after saving the service definition files for later publishing to a server with the Upload Service Definition server tool.
- **ArcGIS Server Folder (optional):** The folder on the ArcGIS Server to publish services to. If no folder is specified, services will be published to the server's root folder.

Choose Tasks category:

- **Publish only selected Tasks (optional):** If enabled, only the tasks selected in the Tasks parameter below will be published. This parameter is enabled when

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the **ENVI Services Folder URL** parameter contains a value.

- **Service (optional):** Choose the service that contains tasks to publish from the drop-down list.
- **Tasks (optional):** Select the tasks to publish.

Publishing Options category:

- **Save toolboxes only (optional):** Enable this option to stop the tool after generating the intermediate Python toolbox files in the "My Toolboxes" directory.
- **Save service definition draft files only (optional):** Enable this option to stop the tool after generating the intermediate service definition draft files (`*.sdd`) in the appropriate staging directory. The files will be available for later staging to service definition files (`*.sd`) with the Stage Service server tool.
- **Save service definition files only (optional):** Enable this option to stop the tool after generating the intermediate service definition files (`*.sd`) in the appropriate staging directory. The files will be available for later publishing with the Upload Service Definition server tool.
- **View results with a map service (optional):** Enable this option to provide all geoprocessing task results as map services.
- **Map ENVIRASTER input to (optional):** ENVI Tasks extensively use a data type called "ENVIRASTER." EFASE maps input and output values of this type to one of two available GPREST data types: GPRasterDataLayer (a raster) or GPDataFile (a file). This field defaults to the appropriate data type, so you should not have to change anything.
- **Map ENVIRASTER output to (optional):** See the above description.

Sharing category: Enter your credentials to optionally publish tasks on the ArcGIS Online portal.

- **Username**
- **Password**
- **ArcGIS Portal URL**

Reassign Tasks

Assign tasks to a new service.

- **ENVI Services URL Folder:** The URI containing the ESE service (for example, `http://server:port/ese/services/my_favorites`).
- **ENVI Services:** The original service.

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- **ENVI Service Tasks:** The tasks to reassign from this service.
- **New ENVI Services Folder URL:** The new URI for the ESE services (for example, `http://server:port/ese/services/AsyncService`).
- **New ENVI Service:** The service that the selected tasks will be reassigned to.

Remove Services

Delete specified services from an ESE folder. ENVI tasks are read-only and cannot be removed.

- **ENVI Services URL Folder:** The URI containing the ESE service (for example, `http://server:port/ese/services/my_favorites`).
- **ENVI Services:** The service to delete.

Remove Tasks

Delete specified tasks from an ENVI service.

- **ENVI Services URL Folder:** The URI containing the ENVI service (for example, `http://server:port/ese/services/my_favorites/tool1`).
- **ENVI Services:** The service containing the tasks to delete.
- **ENVI Service Tasks:** The tasks to delete.

Transfer Data

Move service and task data/metadata into the appropriate folders to share through ENVI services.

- **ENVI Document Root Folder:** The local or network folder that serves as the ENVI services document root. The tool will copy service and task item descriptions, along with sample data and metadata files, to their respective subfolders under this root directory.
- **Service Item Description File (optional):** Service item description file (`.xml`)
- **Task Item Description File (optional):** Task item description file (`.xml`)
- **Task Code Sample File (optional):** Task sample code definition file (`*.task`)
- **Task Sample Data Files (optional):** Task sample data files

Upload Task

Upload IDL tasks to a server hosting ENVI services.

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- **ENVI Services Host:** The ENVI services host URL (for example, `http://server:port`).
- **IDL Task:** The IDL task zip file that contains the IDL programs and task definition file (`*.task`) for a geoprocessing task.

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